

REMARKS

Claims 1-16, 19-21, and 23-30 are pending in the application and are at issue.

Claim 7 has been amended to incorporate a feature deleted from claim 8, which provides support for this amendment.

The present claims are directed to an ester compound, process of preparing the ester, a crosslinked hydrogel using the ester, a polymer and process of preparing the same, a composition containing the ester compound, and articles containing the crosslinked hydrogel. The ester compound is a tri(meth)acrylate of an alkoxyLATED trimethylolpropane. Independent ester claim 1 clearly recites tri(meth)acrylate compounds I. In claim 1, the trimethylolpropane is alkoxyLATED in a blockwise fashion, i.e., first propoxylated, then ethoxylated. A (meth)acrylic acid unit then is positioned at each of the three terminal ends of the alkoxyLATED trimethylolpropane. This is attained by utilizing a molar excess of (meth)acrylic acid to insure that all terminal hydroxyl groups are reacted (e.g., claims 7 and 12), wherein the molar excess of (meth)acrylic acid is specifically recited. In addition, the molar excess of (meth)acrylic acid is not removed from the reaction mixture (e.g., claims 8 and 9).

The claimed esters are hydrophilic having 14 to 16 total moles of ethylene oxide ($n_1 + n_2 + n_3$) and only 4 to 6 total moles of propylene oxide ($m_1 + m_2 + m_3$) (see claim 1). The maximum number of total moles

of alkoxy units is 22 (claim 1). The esters are used in absorbent articles, such as diapers.

Superabsorbent hydrogels and polymers prepared using a presently claimed ester as a crosslinking agent contain a reduced amount of crosslinker residue and demonstrate improved absorption properties, see specification page 47, and compare examples a. through c. to the inventive example d. in the table. Polymers prepared using a claimed ester F as a crosslinking agent also demonstrate improved absorbency results compared to a polymer prepared from a similar crosslinking agent wherein the trimethylolpropane is first ethoxylated, then propoxylated. See specification pages 47 and 48, and compare examples 5a and 5b to the inventive examples 4a and 4b, which first are propoxylated, then are ethoxylated.

Claims 1-16, 19-21, and 23-30 stand rejected under 35 U.S.C. §102(b) as being anticipated by Faul et al. U.S. Patent No. 5,661,220 ('220); Gartner et al. U.S. Patent No. 5,506,324 ('324); Nowakowsky et al. U.S. Patent No. 4,873,299 ('299); and Cohen et al. U.S. Patent No. 3,380,831 ('831). The examiner contends that each of the '220, '324, '299, and '831 patents teach the claimed ester compound and processes using the ester compounds. Applicants traverse these rejections.

The '220 patent teaches reaction products useful as demulsifiers for crude oil emulsions. The reaction product results from a three step process. First, a carboxylic acid I (which can be (meth)acrylic acid) is condensed with a polyetherol II (which can be

an alkoxylated trimethylolpropane), wherein molar ratio of II to I is from 2:1 to 10:1. Importantly, the amount of polyetherol II is present in excess, thus insuring the presence of unreacted terminal hydroxyl groups on the polyetherol II. The resulting condensate product then is polymerized with an unsaturated carboxylic acid and other optional monomers, such that "not all hydroxyl groups are converted" (see '220 patent, abstract and column 1, lines 45-46 for example).

At column 4, lines 9-36, the condensates of the '220 patent are more fully disclosed, i.e., carboxylic acids I are condensed "in the presence of a molar excess of polyetherol II" (lines 10-12) and "process step A) . . . essentially contains the condensate and unconverted polyetherol II" (lines 27-29).

At column 5, lines 29-35, the '220 patent further teaches that the products of the '220 patent are hydrophobic, i.e., are soluble in an oil phase. The '220 patent examples further show that the '220 patent compounds are hydrophobic. In particular, A2 and A3 of the examples, at columns 6 and 7, contain 1 mole of trimethylolpropane condensed with 60 moles of propylene oxide and 10 moles of ethylene oxide, and 80 moles of propylene oxide and 30.3 moles of ethylene oxide, respectively. Therefore, the '220 patent teachings are limited hydrophobic alkoxylated trimethylolpropanes containing far greater amounts of propylene oxide compared to ethylene oxide. The condensate of the '220 patent is prepared using an excess of polyetherol II, and therefore a (meth)acrylic acid unit

cannot be present at each terminal end of the condensate.

The presently claimed esters differ substantially from the condensate products of the '220 patent. First, the esters of claim 1 are tri(meth)acrylates. Each terminal hydroxy group of the trimethylolpropane is capped with a (meth)acrylic acid unit, which is accomplished by using an excess amount of (meth)acrylic acid in the reaction. The '220 condensate products will not be tri(meth)acrylates because the reference teaches a 2:1 to 10:1 mole ratio of polyetherol to carboxylic acid, which precludes formation of the claimed tri(meth)acrylate. The '220 patent also teaches that not all hydroxyl groups are to be reacted, which is a teaching contrary to the present invention.

Second, the presently claimed ester compounds are hydrophilic compounds containing at least two times, and up to four times, more ethylene oxide than propylene oxide units. The condensation products of the '220 patent are hydrophobic compounds containing 2.5 to 6 times less ethylene oxide than propylene oxide, i.e., Examples A2 and A3. The '220 patent fails to teach or suggest a hydrophilic product containing more ethylene oxide units than propylene oxide units.

Third, the methods of producing the esters utilize an excess amount of (meth)acrylic acid, e.g., see claims 7 and 12, and allow the excess to remain in the reaction product, e.g., see claims 8 and 9. This excess amount of (meth)acrylic acid ensures that all terminal hydroxyl groups of the alkoxylated trimethylolpropanes are consumed. In contrast, the '220 patent

specifically teaches that the amount of polyetherol II is in excess (column 4, lines 10-12), which is the exact opposite of the presently claimed invention, and such that excess (meth)acrylic acid will not be present in the reaction product.

In view of the substantial differences between the disclosure of the '220 patent and the present claims, it is submitted that the rejection of the present claims under 35 U.S.C. §102(b) is in error and should be withdrawn. It is further submitted that the present claims would not have been obvious over the '220 patent under 35 U.S.C. §103 for the reasons set forth above and hereafter.

The product of the '220 patent, and the intermediate products, all are hydrophobic compounds that are designed for oil solubility to act as a demulsifier. The '220 patent teaches using an excess polyetherol and retaining some unreacted hydroxyl groups in the reaction product.

In contrast, the present claims are directed to a hydrophilic ester compound, which can be used in an aqueous polymerization process to form superabsorbent polymers. The present esters are prepared using an excess of (meth) acrylic acid, which is the exact opposite of the '220 patent teachings. The excess amount of (meth)acrylic acid ensures the preparation of a tri(meth)acrylate, as claimed, which also is in direct contrast to the '220 patent. The '220 patent discourages the formation of a tri(meth)acrylate by using excess polyetherol.

A person skilled in the art, after reading the '220 patent, would not have been motivated to make the radical modifications necessary to arrive at the presently-claimed invention. The '220 patent teaches hydrophobic products that would not be useful in preparing superabsorbent polymers. A hydrophobic component would adversely effect the water absorbent properties of such a polymer.

Overall, a person skilled in the art would have to totally redesign the condensate product of the '220 patent to arrive at the presently claimed invention. The skilled person would have to act completely contrary to the teachings of the '220 patent, i.e., invert the mole ratio of hydrophobic alkylene oxide to hydrophilic alkylene oxide and invert the mole ratio of alkoxylated trimethylolpropane to (meth)acrylic acid.

Not only do such drastic changes from the teachings of the '220 patent result in a completely different product from the '220 patent, but the '220 patent provides no incentive for a person skilled in the art to consider making such drastic changes. It is further submitted that the subject matter of the '220 patent (oil demulsifiers) is so different from the field of the subject matter of the present claims (i.e., superabsorbent polymers and crosslinkers therefor) that persons skilled in the art of superabsorbent polymers would not even consider the nonanalogous '220 patent.

In summary, for the reasons set forth above, not only are the present claims novel over the '220

patent, but the present claims also would not have been obvious over the '220 patent under 35 U.S.C. §103.

The '324 patent is directed to alkoxyLATED C₂-10 polyhydric hydrocarbons. The polyhydric hydrocarbon can be trimethylolpropane. Generally, the alkylene oxide can be ethylene oxide, propylene oxide, or a mixture thereof, in a random or block arrangement. See '324 patent, column 4, lines 27-37.

However, the '324 patent fails to teach or suggest an alkoxyLATED trimethylolpropane as presently claimed. Outside of the general disclosure of the '324 patent with respect to alkoxyLATED trimethylolpropanes and (meth)acrylates thereof, the only specific teachings are in the examples of the '324 patent. In particular, Examples 1-38 of the '324 patent each utilize a commercial ethoxyLATED trimethylolpropanes, in particular the Sartomer products. These products also are discussed in the present specification at page 3, line 24 through page 4, line 9, which addresses the disadvantages of these compounds that are overcome by the presently claimed esters. The examples of the '324 patent fail to include any propylene oxide, let alone the type of ester recited in the present claims.

In particular, the present claims recite an ester having a recited number of propylene oxide units and a recited number of ethylene oxide units, in a particularly claimed arrangement. These claimed esters are neither taught nor suggested in the '324 patent.

It is axiomatic that for a reference to anticipate a claim, the identical invention must be shown in as complete detail as contained in the claim.

See M.P.E.P. §2131. The '324 patent discloses no more than a general teaching of (meth)acrylates of an alkoxylated trimethylolpropane. Although the reference discloses that the alkylene oxide may be propylene oxide, the '324 patent contains no specific teaching of any propoxylated product or block product, let alone a block propoxylated-ethoxylated product having the present claimed structure. Accordingly, it is submitted that the anticipated rejection of claims 1-16, 19-21, and 23-30 under 35 U.S.C. §102(b) over the '324 patent is in error and should be withdrawn.

It is further submitted that the differences between the present claims and the '324 patent are nonobvious differences. Applicants specifically demonstrated the improvements provided by a claimed tri-(meth)acrylate of the alkoxylated trimethylolpropane, i.e., having the recited number of propylene oxide and ethylene oxide, and arranged as recited in the present claims. Applicants demonstrated that a compound having the *same* number of propylene oxide and ethylene oxide units but arranged *differently* provides different and *inferior* absorption results. See specification, pages 46-49. These new and unexpected results demonstrated by the present invention are derived from the presently claimed esters being propoxylated first, then ethoxylated, and having the recited number of propoxy and ethoxy groups.

After reading the '324 patent, a person skilled in the art would not have been motivated to alkoxylate trimethylolpropane as presently claimed with any reasonable expectation of achieving the improved

absorbency results provided by the presently claimed ester crosslinkers. The '324 patent is limited to a general teaching that propylene oxide can be used to alkoxylate trimethylolpropane. No propoxylated examples are provided, and the '324 patent contains no disclosure suggesting the propoxylated trimethylolpropane would provide any benefits over the ethoxylated compounds, which are the only compounds provided in the '324 patent. The '324 patent also teaches a preference for ethylene oxide at column 4, line 41.

In summary, for the reasons set forth above and with respect to the '220 patent, it is submitted that the present claims are both novel over the '324 patent and would not have been obvious over the '324 patent.

The '299 patent discloses crosslinking compounds at column 3, lines 4-25. Specifically, the '299 patent discloses numerous crosslinking agents and different classes of crosslinking agents including "adducts of ethylene oxide and/or propylene oxide with trimethylolpropane which have been diesterified or triesterified with acrylic acid or methacrylic acid" (column 3, lines 15-18). The three examples of the '299 patent each disclose a crosslinker that is completely different from tri(meth)acrylate of an alkoxylated trimethylolpropane, i.e., N,N'-methylene-bisacrylamide, butanediol divinylether, and divinylbenzene. These compounds are in no way structurally similar to the presently claimed esters, and, in fact, are not even esters.

Accordingly, the '299 patent teaches no more than the '324 patent, i.e., a general teaching that trimethylolpropane can be ethoxylated and/or propoxylated, then reacted with (meth)acrylic acid to provide a crosslinking agent. The '299 patent provides no incentive for a person skilled in the art to ethoxylate and propoxylate trimethylolpropane as set forth in the claims with any reasonable expectation of ultimately providing absorbent polymers having an improved absorbency profile. It is submitted, therefore, that the present claims are neither anticipated under 35 U.S.C. §102(b) nor obvious under 35 U.S.C. §103 over the '299 patent for the same reasons claims 1-16, 19-21, and 23-30 are patentable over the '324 patent and the '220 patent.

The '831 patent discloses "polyoxyethyltrimethanol triacrylate or polyoxyethyltrimethanol trimethacrylate" ('831 patent, abstract, column 1, lines 7 and 18). The '831 patent further discloses extending trimethylolpropane with ethylene oxide and propylene oxide (column 3, lines 39-46). The '831 patent provides no examples of a trimethylolpropane that is both ethoxylated and propoxylated (see Examples I-IV of the '831 patent).

In fact, the '831 patent specifically precludes both ethoxylated and propoxylated by teaching that the trimethylolpropane is either ethoxylated or propoxylated, i.e., Q is H, CH_3 , or C_2H_5 (column 3, line 31). The language of the '831 patent does not teach or suggest that Q is independently selected from H, CH_3 ,

and C_2H_5 , thus only ethoxylation or propoxylation of trimethylolpropane is disclosed.

Further, and importantly, the '831 patent teaches that the extended trimethylolpropane of the '831 patent has a *free* hydroxyl group at one terminal end. See structure at column 3, lines 21-31.

Accordingly, the compound disclosed in the '831 patent is substantially different from the presently claimed tri(meth)acrylated esters. The compound of the '831 has (a) a free hydroxy group at one end of the molecule and (b) contains ethylene oxide or propylene oxide, but not both. The present claims recite a trimethylolpropane that is propoxylated and ethoxylated in a specific order and that has *no* free hydroxy group at a terminal end.

Therefore, the present claims cannot be anticipated by the '831 patent for the same reasons set forth above with respect to the '220 and '324 patents. In addition, the present claims would not have been obvious over the '831 patent for the same reasons that the claims would not have been obvious over the '220 and '324 patents, and for the further additional reason that the '831 patent specifically teaches ethoxylation or propoxylation, rather than both as in the presently claimed esters.

In summary, it is submitted that the present claims are patentable over the '220, '324, '299, and '831 patents, and that the rejections should be withdrawn, and that the present claims are in a form and condition for allowance. An early and favorable action on the merits is respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form in an effort to advance this application toward allowance, the examiner is urged to telephone the undersigned at the indicated number.

Respectfully submitted,

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October 13, 2006